What is *Nasturtium tibeticum* (Brassicaceae)?

Ihsan A. Al-Shehbaz
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. The status of *Nasturtium tibeticum* is discussed, and the new combination *Dontostemon tibeticus* is proposed. Accounts of *N. tibeticum* in some Chinese floras are based on plants of the new species *Phaeonychium fengii*. The distinguishing characters of *Nasturtium*, *Dontostemon*, and *Phaeonychium* are presented.

During the revision of Brassicaceae for the *Flora of China*, it became evident that the identity and generic placement of the poorly known *Nasturtium tibeticum* Maximowicz were erroneously interpreted in several accounts of the family for provincial and national Chinese floras. As shown below, such accounts involve two species more appropriately placed in *Dontostemon* Andrzejowski ex C. A. Meyer and *Phaeonychium* O. E. Schulz. Unfortunately, treatments of these two genera (Al-Shehbaz, 2000; Al-Shehbaz & Ohba, 2000) were already in press when I started working on the *N. tibeticum* problem and, therefore, it was not possible to incorporate the following findings into those two publications.

Although Maximowicz (1889) provided detailed description and illustrations of *Nasturtium tibeticum*, he did not discuss its generic placement and only indicated that it cannot be placed in *Sisymbrium* L. on account of its accumbent instead of incumbent cotyledons. That original disposition of *N. tibeticum* has not been questioned until the present, though Schulz (1933, 1936) recognized its anomalous position in *Nasturtium* R. Brown and placed it in the monotypic section *Ktenokardamum* O. E. Schulz. However, Schulz's broad concept of *Nasturtium* included also all of *Rorippa* Scopoli and a few species presently assigned to other genera.

As delimited by Al-Shehbaz and Price (1998), *Nasturtium* includes five species, of which two are native to North America, two to Europe, and one to North Africa. It consists of aquatic perennials with hollow stems rooting at the submersed lowermost nodes, pinnately compound emergent leaves with nondecurrent lateral leaflets, and coarsely reticulate seeds. *Nasturtium tibeticum* clearly does not belong to this genus because it is a terrestrial biennial with solid stems not rooting at the lowermost nodes, pectinate-pinnatifid leaves with decurrent lateral leaf lobes, and minutely reticulate seeds. In every aspect of the plant, *N. tibeticum* is most at home in *Dontostemon* (including *Dimorphostemon* Kitagawa), an Asian genus of ten species (Al-Shehbaz & Ohba, 2000). The species, hereafter known as *D. tibeticus*, has multicellular glandlike warts on the fruit valve but not the typical glands characteristic of four of the ten species of *Dontostemon*, nor does it have the connate median filaments found in eight of those ten species. However, it has broadly expanded and sometimes minutely denticulate bases of the median staminal filaments, distinctly 2-lobed stigmas, accumbent cotyledons, white flowers with purplish petal claws, and strongly divided leaves. In this, *D. tibeticus* is more similar to *D. pinnatifidus* (Willdenow) Al-Shehbaz & H. Ohba than to other Himalayan or Asian species. From other species of *Dontostemon*, *D. tibeticus* is readily distinguished by having pectinate-pinnatifid leaves, prominently 2-lobed stigmas with subdecurrent lobes, and free, basally flattened bases of the median staminal filaments.

The descriptions and illustrations of *Dontostemon tibeticus* (as *Nasturtium*) in *Flora Qinghaiica* (Huang, 1997) and *Flora Xizangica* (Kuan, 1985) were accurate, but those in other floras (see below) were not. Because of the confusion in the identity of this species, a detailed description and citation of specimens are provided. Excellent illustrations of the species can be found in Maximowicz (1889) and Huang (1997).

Dontostemon tibeticus (Maximowicz) Al-Shehbaz, comb. nov. Basionym: *Nasturtium tibeticum* Maximowicz, Fl. Tangut. 54. 1889. TYPE: China. Tibet: alpine areas at River Bö-Tschü, 25 June–7 July 1884, *N. M. Przewalski s.n.* (lectotype, here designated, LE, photo MO; isotypes, P, PE).

Herbs biennial, (1.5–)4–14(–20) cm tall, pilose with simple trichomes to 1.5 mm, with a somewhat fleshy root. Stems often few from base, simple above. Basal and lowermost stem leaves eglandular; petiole (0.3–)1–2 cm long; leaf blade lanceolate to oblong or oblanceolate in outline, somewhat fleshy, (0.7–)1.2–2.7(–3.5) cm × (3–)5–10(–14) mm, base attenuate to cuneate, margin pectinate-pinnatifid,

apex acute; lateral lobes (4 to) 7 to 11, to 5 × 2.5 mm, decurrent, sometimes imbricate, abaxially toothed or entire, adaxially entire, acute; uppermost stem leaves sessile. Fruiting pedicel divaricate, (2–)3–7(–9) mm long, eglandular, stout. Sepals ovate, 3–4 × 1.5–2 mm, sparsely hairy apically or glabrous, lateral pair slightly saccate. Petals white with pink or purplish claws, obcordate, 5–8 × 2.5–3.5(–4) mm, apex emarginate; claw 3–4 mm long. Filaments of median stamens 3–4 mm long, free, flattened and sometimes minutely toothed on 1 side; filament of lateral stamens 2–2.5 mm long, slender; anthers oblong, 0.7–1 mm long, not apiculate. Ovules 12 to 20 per ovary. Fruit (0.8–)1–1.5(–1.7) cm × (0.8–)1–1.3 mm, straight, torulose, terete; valves with a prominent midvein, with multicellular glandlike warts; style 1–3 mm long; stigma prominently 2-lobed, lobes subdecurrent. Seeds brown, oblong-ovate, 1.4–1.6 × 0.9–1 mm, wingless; cotyledons accumbent. Flowering June–July, fruiting July–August.

Loose scree, disturbed alpine meadows, moist gravelly slopes, permafrost gravel and sandstone, steep rocky slopes; 3200–5200 m. Gansu, Qinghai, Xizang.

Maximowicz (1889) cited three syntypes all mounted on the same sheet at LE. The collection with nearly mature fruits and on which the original illustration was based is taken here as the type. The other two syntypes have rather young racemes and no fruits. The species is restricted to Xizang, Qinghai, and adjacent Gansu. The record from Gansu Province is reported here for the first time. The records of *Dontostemon tibeticus* (as *Nasturtium*) from Sichuan (Guo, 1987; Wang, 1993; Tan et al., 1999) are based on plants of the new species *Phaeonychium fengii.*

Specimens examined. CHINA. **Gansu:** Yong Ngun, Nan Qiau, *Villant 883* (P). **Qinghai:** Chindu Xian, Qingshuihe Xiang, W of road between Madoi and Yushu on road to Zadoi just S of Qingshuihe, 33°45′N, 97°7′E, *Ho, Bartholomew, Watson & Gilbert 1606* (BM, CAS, E, HNWP, MO); 33°45′N, 97°3′E, *Ho, Bartholomew, Watson & Gilbert 1643* (BM, CAS, E, HNWP, MO); Chindu Xian, 33°07′39″N, 97°27′44″E, *Boufford, Lu & Ying 26912* (MO); Madoi Xian, NE of Bayan Har Pass, on road between Madoi and Yushu, 34°11′N, 97°46′E, *Ho, Bartholomew, Watson & Gilbert 1703* (BM, CAS, E, HNWP, MO); Madoi to Yushu, E summit of Bayen Har Pass, 25 July 1996, *Perring s.n.* (E); Kou-kou-nor, 24 Nov. 1938, *Neel s.n.* (P), Madoi Xian, *Wu 668, 1162* (HNWP); Guide Xian, *Huang 3561* (HNWP); Angqin Xian, *Wang 687* (HNWP). **Xizang (Tibet):** Tangula Shan, Taoer Jiu Yakou, 32°33′N, 91°51′E, *Dickoré 4138* (GOET, MO); Bi Qu Wenquan-Yanshiping (Lhasa-Golmud Rd.), 33°31′N, 91°58′E, *Dickoré 4157* (GOET, MO); River Tala Chu, 18 June 1884, *Przewalski s.n.* (LE, PE); mountains between Huang He and Blue River, 10 June 1884, *Przewalski s.n.* (LE).

Phaeonychium fengii Al-Shehbaz, sp. nov. TYPE: China. Yunnan: Pai-shu-ho, by NE Likiang Snow Range, open moist streams, 3 Apr. 1939, *K. M. Feng 654* (holotype, A; isotype, PE).

Herba perennis caespitosa caudice pauciramoso et lignoso; caules, pedicelli fructusque pilis submalpighiaceis obtecti, folia sepalaque pilis simplicibus et submalpighiaceis. Folia basalia rosulata, petiolata, oblonga vel oblanceolata, 3–15 × 1.5–6 mm, grosse dentata vel lyrata. Pedicelli fructiferi divaricato-ascendentes, 5–10 mm longi. Sepala oblonga, 2.5–3.5 × 1–1.5 mm, sparse pilosa, caduca. Petala rosea, obovata, 6–7 × 3.5–4 mm; ungues 1.5–2 mm longi. Ovula 12–16. Fructus immatures teretes, pilosi; stylus ca. 1 mm longus; stigma bilobatum. Semina matura ignota.

Herbs perennial, 3–9 cm tall, caespitose; caudex stout, woody, few branched, to 8 mm diam., covered with petiolar remains of previous years. Trichomes submalpighiaceous on stems, pedicels, and fruits, these mixed with simple ones especially on leaves and sepals. Stems erect, simple from caudex. Basal leaves rosulate; petiole 0.5–1.5 cm long, ciliate with simple trichomes to 1 mm long, becoming papery at base; leaf blade oblong to oblanceolate, 3–15 × 1.5–6 mm, sparsely pilose, base attenuate, margin coarsely dentate and with 3 to 7 teeth on each side, or lyrate, rarely earliest ones subentire, apex subacute. Upper stem leaves similar to basal, subsessile. Racemes corymbose, ebracteate or lowermost 1 or 2 flowers bracteate. Young fruiting pedicel divaricate-ascending, straight, 5–10 mm long. Sepals oblong, 2.5–3.5 × 1–1.5 mm, sparsely pilose, caducous, margin membranous. Petals rose-pink, obovate, 6–7 × 3.5–4 mm, apex rounded; claw 1.5–2 mm long. Filaments slender; median pairs 2.5–3.5 mm long; lateral pair 2–2.5 mm long; anthers oblong, 0.7–0.8 mm long. Ovules 12–16 per ovary. Young fruits terete, pilose; style ca. 1 mm long; stigma 2-lobed. Mature seeds unknown.

Records of *Nasturtium tibeticum* in Guo (1987), Wang (1993), and Tan et al. (1999) are all based on a single misidentified collection, *Feng 654* (PE), of the new species *Phaeonychium fengii.* Plants of this collection are caespitose perennials with woody caudices, slender, toothless, free staminal filaments, confluent median nectar glands, and short-stalked submalpighiaceous trichomes on the stems, pedicels, and young fruits. The species cannot be placed in *Nasturtium* or *Dontostemon,* because these two genera lack branched trichomes and median nectar glands. Furthermore, the lack in *P. fen-*

gii of glandular trichomes and of connate or flattened/toothed median staminal filaments clearly excludes it from *Dontostemon*. All species of *Phaeonychium*, including *P. fengii*, have branched trichomes, woody caudices with petiolar remains of previous years, and confluent median nectar glands (Al-Shehbaz, 2000). Although the type collection of *P. fengii* does not have mature fruits and seeds, its generic placement is best in *Phaeonychium* rather than in any other known genus. However, the coarsely dentate to lyrate leaves in *P. fengii* are somewhat anomalous in the genus because almost all of the other six species of *Phaeonychium* have entire leaves, though *P. albiflorum* (T. Anderson) Jafri sometimes has apically 1- to 3-toothed leaves. *Phaeonychium fengii* is readily distinguished from the other species of the genus by its coarsely dentate to lyrate leaves and submalpighiaceous stalked trichomes that cover the stems, pedicels, and fruits. It is most similar to *P. albiflorum*, which has entire to rarely 1- to 3- toothed leaves and dendritic and forked instead of submalpighiaceous trichomes. The illustrations in Guo (1987) and Tan et al. (1999) of *P. fengii* (as *N. tibeticum*) are representative and should be consulted.

Phaeonychium fengii is known thus far only from the type collection, which consists of 18 plants on two sheets. Wang (1993) cited under *N. tibeticum* another collection, *Sichuan Vegetation Expedition Team 15143*, besides that of the type gathering of *P. fengii*, but I have not seen that collection and therefore I am unable to determine its generic placement.

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